

P/ ENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 04 July 2001 (04.07.01)	
International application No. PCT/US00/21377	Applicant's or agent's file reference 3708 PCT
International filing date (day/month/year) 04 August 2000 (04.08.00)	Priority date (day/month/year) 06 August 1999 (06.08.99)
Applicant MOFFATT, Stephen	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 20 February 2001 (20.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer H. Zhou
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PCT

REC'D 30 OCT 2001

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

IPEA

PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 3708/CT/203.24	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US00/21377	International filing date (day/month/year) 04 AUGUST 2000	Priority date (day/month/year) 06 AUGUST 1999
International Patent Classification (IPC) or national classification and IPC IPC(7): A61N 5/00; G21G 5/00 and US Cl.: 250/492.2		
Applicant APPLIED MATERIAL, INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 20 FEBRUARY 2001	Date of completion of this report 08 AUGUST 2001
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer <i>Sharon J. Hoppe</i> TERESA ARROYO
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0956

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed
- ☒ the description:
pages 1-18 , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____
- ☒ the claims:
pages 19-27 , as originally filed
pages NONE , as amended (together with any statement) under Article 19
pages NONE , filed with the demand
pages NONE , filed with the letter of _____
- ☒ the drawings:
pages 1-4 , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____
- ☒ the sequence listing part of the description:
pages NONE , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/fig NONE

5. ☐ This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

**Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/21377

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. statement**

Novelty (N)

Claims	<u>1-40</u>	YES
Claims	<u>NONE</u>	NO

Inventive Step (IS)

Claims	<u>1-40</u>	YES
Claims	<u>NONE</u>	NO

Industrial Applicability (IA)

Claims	<u>1-40</u>	YES
Claims	<u>NONE</u>	NO

2. citations and explanations (Rule 70.7)

Claims 1-40 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a wafer holder capable of retaining a substrate with in a processing chamber. This said holder comprises an electrode, and one or more layers covering the portion of the wafer holder in contact with the wafer. The prior art also fails to clearly suggest a method for patterning a photoresist layer on a substrate comprising the steps of forming the layer, positioning the substrate on the holder, and exposing the layer to a charged particle.

_____ NEW CITATIONS _____
NONE

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 3708 PCT	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> FOR FURTHER ACTION </div> <div style="font-size: small;"> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. </div> </div>	
International application No. PCT/US 00/ 21377	International filing date (day/month/year) 04/08/2000	(Earliest) Priority Date (day/month/year) 06/08/1999
Applicant APPLIED MATERIALS, INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 7 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☒ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

- ☐ as suggested by the applicant.
 - ☐ because the applicant failed to suggest a figure.
 - ☒ because this figure better characterizes the invention.
- 3
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/21377

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-9, 11-14, 17, 18

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-9,11-14,17,18

A wafer holder for retaining a substrate within a process chamber, comprising:

- an electrode, so that the wafer holder can also be called electrostatic chuck; and
- one or more layers covering a portion of the wafer holder in contact with the wafer, where at least one of the layers is compliant.

An apparatus for projecting patterned charged particles onto a substrate, comprising:

- a processing chamber;
- a charged particle source for generating a charged particle beam that impinges on the substrate; and
- an electrostatic chuck as described above.

2. Claims: 10,15,16

An apparatus for projecting patterned charged particles onto a substrate, comprising:

- a processing chamber;
- a charged particle source for generating a charged particle beam that impinges on the substrate;
- an electrostatic chuck comprising an electrode and one or more layers covering a portion of the wafer holder in contact with the wafer where at least one of the layers is compliant; and comprising:
- a computer for calculating an estimated charged particle beam deflection to compensate for the actual deformation of the substrate, wherein the computer generates a deflection signal corresponding to the calculated deflection;
- a beam deflector for deflecting the charged particle beam in response to the deflection signal from the computer; or comprising:
- a lithography mask between the charged particle source and the substrate;
- an electron sensor for detecting backscattered electrons;

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

or comprising:

- a substrate temperature sensor for sending a signal corresponding to the measured substrate temperature to the computer.

3. Claims: 19-25

A method for patterning a photoresist layer on a substrate comprising the steps of:

- forming a photoresist layer on the substrate;
- positioning the substrate on an electrostatic chuck having one or more layers covering a portion of the wafer holder in contact with the wafer where at least one of the layers is compliant; and
- exposing portions of the photoresist layer on the substrate to a charged particle beam.

4. Claims: 26-28

An electrostatic chuck for use in substrate processing, the chuck having an electrode covered by an insulative layer for receiving the substrate, wherein the insulative layer is elastic and can withstand 10% shear stress without exceeding the material yield strength.

5. Claims: 29-35

A method for holding a wafer on a chuck having an electrode and one or more layers covering a portion of the wafer holder in contact with the wafer where at least one of the layers is compliant, comprising the steps of:

- placing the wafer on one of the layers of the chuck; and
- energizing the electrode.

6. Claims: 36-40

An apparatus for handling a substrate for use in semiconductor processing, comprising:

- a wafer holder; and
- one or more layers covering a portion of the wafer holder in contact with the wafer where at least one of the layers is compliant.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/21377

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	<p>US 5 452 177 A (FRUTIGER WILLIAM A) 19 September 1995 (1995-09-19)</p> <p>column 4, line 40 - line 55 column 6, line 50 - line 63 column 7, line 31 - line 64 column 9, line 35 - line 50 ---</p> <p style="text-align: center;">-/--</p>	<p>1,2,5,6, 8,9,13, 14, 26-30, 33,34, 36,37,39 3,4</p>

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

10 January 2001

Date of mailing of the international search report

15.06.01

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Giordani, S

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/21377

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 729 423 A (CLINTON JON T ET AL) 17 March 1998 (1998-03-17) column 2, line 54 -column 3, line 23 column 4, line 14 - line 65 column 7, line 14 - line 67 column 10, line 29 - line 47 column 11, line 32 - line 44 ---	1,3,5,6, 26,28, 29, 33-36,39 4,31
X A	US 5 310 453 A (FUKASAWA KAZUO ET AL) 10 May 1994 (1994-05-10) column 3, line 42 - line 65 column 5, line 56 -column 6, line 10 ---	1,3,6, 29,34, 36,39 8,11,14, 26-28
X A	US 4 665 463 A (WARD RODNEY ET AL) 12 May 1987 (1987-05-12) column 2, line 34 -column 3, line 29 ---	1,6,8, 14,26, 28,29, 34,36,39
X A	US 4 480 284 A (TOJO TORU ET AL) 30 October 1984 (1984-10-30) the whole document ---	1,5,6, 29,33, 34,36,39 2-4,7, 26-28, 30-32, 35,37, 38,40
X A	EP 0 856 882 A (APPLIED MATERIALS INC) 5 August 1998 (1998-08-05) column 2, line 38 - line 54 column 3, line 44 -column 5, line 46 ---	1,3,6, 36,39 2,4, 26-34
X A	US 5 883 778 A (RYAN ROBERT E ET AL) 16 March 1999 (1999-03-16) column 6, line 12 - line 27 column 8, line 36 - line 44 column 10, line 27 -column 11, line 10 ---	1-6, 26-39
X	EP 0 692 814 A (APPLIED MATERIALS INC) 17 January 1996 (1996-01-17) column 7, line 17 -column 9, line 26 -----	1,6,7, 26,28, 29, 34-36, 39,40

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/21377

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5452177 A	19-09-1995	DE 69316872 D DE 69316872 T EP 0620953 A JP 7506465 T WO 9411944 A EP 0460955 A	12-03-1998 28-05-1998 26-10-1994 13-07-1995 26-05-1994 11-12-1991
US 5729423 A	17-03-1998	US 5745331 A EP 0844659 A JP 10247683 A US 5986875 A US 5753132 A US 5801915 A EP 0692156 A JP 10294358 A JP 10070893 A JP 8507196 T WO 9520838 A	28-04-1998 27-05-1998 14-09-1998 16-11-1999 19-05-1998 01-09-1998 17-01-1996 04-11-1998 10-03-1998 30-07-1996 03-08-1995
US 5310453 A	10-05-1994	JP 3027781 B JP 5226291 A JP 5226292 A JP 5275385 A KR 164618 B	04-04-2000 03-09-1993 03-09-1993 22-10-1993 01-02-1999
US 4665463 A	12-05-1987	GB 2147459 A DE 3471827 D EP 0138254 A JP 1942460 C JP 6073362 B JP 60095933 A	09-05-1985 07-07-1988 24-04-1985 23-06-1995 14-09-1994 29-05-1985
US 4480284 A	30-10-1984	JP 1336989 C JP 58137536 A JP 60059104 B DD 211675 A FR 2520930 A	11-09-1986 16-08-1983 23-12-1985 18-07-1984 05-08-1983
EP 0856882 A	05-08-1998	US 6217655 B JP 10275853 A TW 403990 B US 6117246 A	17-04-2001 13-10-1998 01-09-2000 12-09-2000
US 5883778 A	16-03-1999	EP 0755066 A JP 9129715 A DE 69500566 D DE 69500566 T EP 0669644 A JP 2840041 B JP 8046019 A US 5634266 A US 5671117 A	22-01-1997 16-05-1997 25-09-1997 29-01-1998 30-08-1995 24-12-1998 16-02-1996 03-06-1997 23-09-1997
EP 0692814 A	17-01-1996	US 5646814 A AT 160238 T DE 69501018 D DE 69501018 T JP 8203991 A	08-07-1997 15-11-1997 18-12-1997 20-05-1998 09-08-1996

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



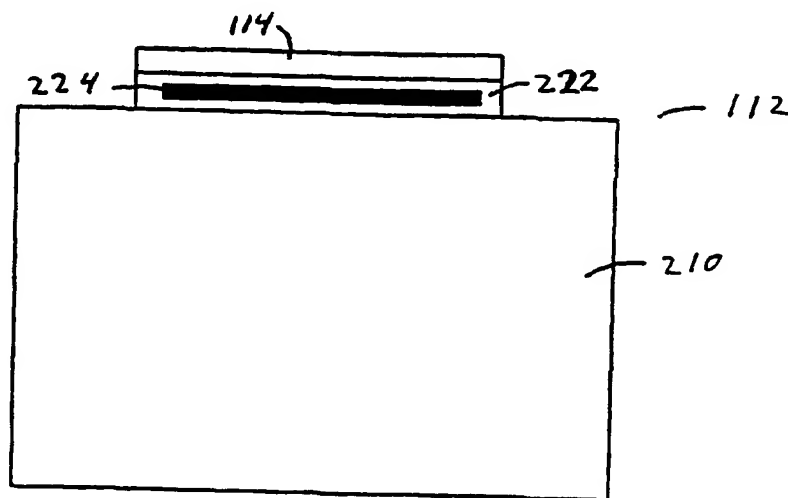
(43) International Publication Date
15 February 2001 (15.02.2001)

PCT

(10) International Publication Number
WO 01/11431 A2

- (51) International Patent Classification⁷: **G03F 7/20** [GB/US]; 3544 Washington Boulevard, Jersey City, NJ 07310 (US).
- (21) International Application Number: PCT/US00/21377
- (22) International Filing Date: 4 August 2000 (04.08.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/147,684 6 August 1999 (06.08.1999) US
- (71) Applicant (for all designated States except US): **APPLIED MATERIALS, INC.** [US/US]; 3050 Bowers Avenue, Santa Clara, CA 95054 (US).
- (74) Agent: **DERGOSITS, Michael**; Dergosits & Noah LLP, Suite 1150, Four Embarcadero Center, San Francisco, CA 94111 (US).
- (81) Designated States (national): JP, KP, US.
- (84) Designated States (regional): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).
- Published:**
— Without international search report and to be republished upon receipt of that report.
- (72) Inventor; and
(75) Inventor/Applicant (for US only): **MOFFATT, Stephen**
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND APPARATUS OF HOLDING SEMICONDUCTOR WAFERS FOR LITHOGRAPHY AND OTHER WAFER PROCESSES



(57) Abstract: A wafer chuck is designed to allow the substrate to thermally deform during charged particle beam lithography. The wafer chuck includes a compliant layer disposed over a chuck body. During lithography processing the wafer is electrostatically held in contact with a flexible compliant layer and the wafer is exposed to the charged particle beam resulting in thermal deformation of the wafer. The compliant layer deforms with the substrate and allows the wafer to deform in a predictable manner.

WO 01/11431 A2

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
15 February 2001 (15.02.2001)

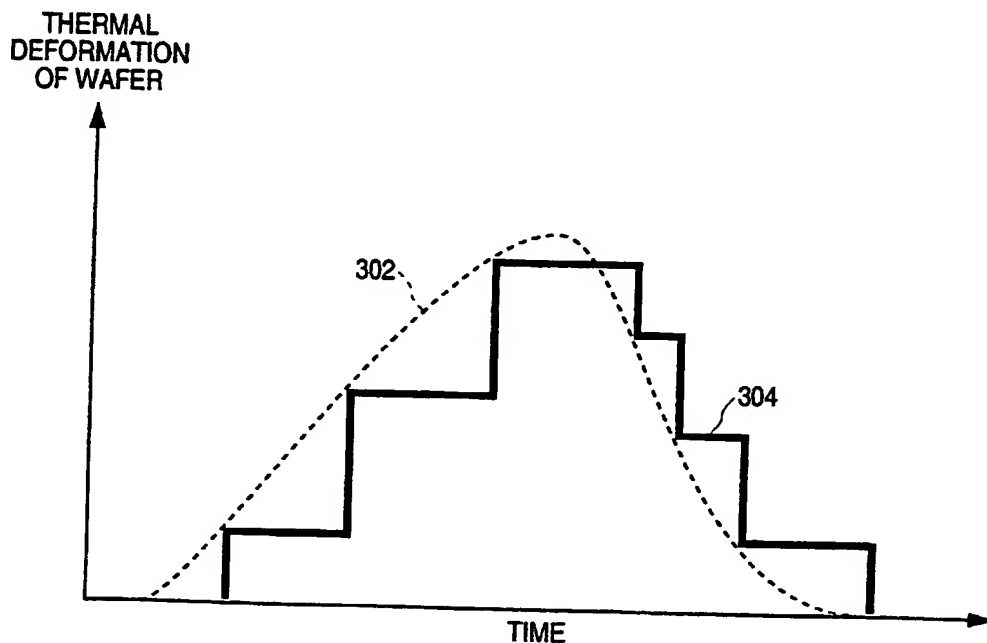
PCT

(10) International Publication Number
WO 01/11431 A3

- (51) International Patent Classification⁷: **H01L 21/00** (74) Agent: **DERGOSITS, Michael**; Dergosits & Noah LLP, Suite 1150, Four Embarcadero Center, San Francisco, CA 94111 (US).
- (21) International Application Number: **PCT/US00/21377**
- (22) International Filing Date: **4 August 2000 (04.08.2000)** (81) Designated States (*national*): **JP, KP, US.**
- (25) Filing Language: **English** (84) Designated States (*regional*): **European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).**
- (26) Publication Language: **English**
- (30) Priority Data:
60/147,684 **6 August 1999 (06.08.1999)** **US**
- (71) Applicant (*for all designated States except US*): **APPLIED MATERIALS, INC.** [US/US]; 3050 Bowers Avenue, Santa Clara, CA 95054 (US).
- (88) Date of publication of the international search report:
15 November 2001
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): **MOFFATT, Stephen** [GB/US]; 3544 Washington Boulevard, Jersey City, NJ 07310 (US).
- Published:
— *with international search report*
— *with amended claims and statement*
- Date of publication of the amended claims and statement:
20 December 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **METHOD AND APPARATUS OF HOLDING SEMICONDUCTOR WAFERS FOR LITHOGRAPHY AND OTHER WAFER PROCESSES**



(57) Abstract: A wafer chuck is designed to allow the substrate to thermally deform during charged particle beam lithography. The wafer chuck includes a compliant layer disposed over a chuck body. During lithography processing the wafer is electrostatically held in contact with a flexible compliant layer and the wafer is exposed to the charged particle beam resulting in thermal deformation of the wafer. The compliant layer deforms with the substrate and allows the wafer to deform in a predictable manner.

WO 01/11431 A3

AMENDED CLAIMS

[received by the International Bureau on 15 August 2001 (15.08.01);
original claims 1 and 8 amended; remaining claims unchanged (2 pages)]

1. A wafer holder for retaining a substrate within a processing chamber comprising:
an electrode; and
one or more layers covering a portion of the wafer holder and having a compliant
5 surface for supporting the substrate which moves with the substrate in a direction parallel
to a planar surface of the substrate when the substrate expands or contracts.
2. The chuck of claim 1 wherein the compliant layer has a hardness between 25 and
100 Shore Hardness scale A.
3. The chuck of claim 1 wherein the compliant layer is an insulator having a
dielectric constant between 1 and 3.
- 10 4. The chuck of claim 1 wherein the compliant layer can withstand 10% shear stress
without exceeding the yield strength of the compliant layer material.
5. The chuck of claim 1 wherein the electrode comprises at least one conductive
material selected from the group consisting of: copper, nickel, chromium, aluminum
15 iron, and mixtures or alloys thereof.
6. The chuck of claim 1 wherein the compliant layer comprises an insulative
material selected from the group consisting of: fluorosilicones, polyamides, polyimides,

polyketones, polyetherketones, polysulfones, polycarbonates, polystyrenes,
polyurethanes, nylons, polyvinylchlorides, polypropylenes, polyetherketones,
polyethersulfones, polyethylene terephthalate, fluoroethylene propylene copolymers,
5 cellulose, triacetates, silicones and rubbers, and combinations thereof.

7. The chuck of claim 1 wherein the compliant layer is between 1 and 3 μm thick.

8. An apparatus for projecting patterned charged particles onto a substrate
comprising:

10 a processing chamber;

a charged particle source for generating a charged particle beam that impinges on
the substrate; and

an electrostatic chuck comprising an electrode and one or more layers covering a
portion of the wafer holder and having a compliant surface for supporting the substrate
15 which moves with the substrate in a direction parallel to a planar surface of the substrate
when the substrate expands or contracts.

9. The apparatus of claim 8 wherein the compliant layer has a hardness between 25
and 100 Shore Hardness scale A.

10. The apparatus of claim 8 further comprising:

20 a computer for calculating an estimated charged particle beam deflection to
compensate for the actual deformation of the substrate caused by the exposure of the

STATEMENT UNDER ARTICLE 19 (1)

In the International Search Report, the Examiner cited several references as being of particular relevance alone. All of these references disclose an electrostatic wafer support having an insulative layer which contacts the substrate. Applicant submits that although some of the cited references disclose a vertically compressible insulative layer, none of the references disclose a compliant layer that moves with the substrate in a direction parallel to a planar surface of the substrate as the substrate expands or contracts. In particular, during wafer processing, the temperature of the substrate tends to increase resulting in thermal expansion. A substrate surface is required which is mechanically stable elevated temperatures and sufficiently elastic to move with the expanding and contracting substrate.

The Examiner cited U.S. Patent Nos. 5,883,778, 5,729,423, 5,452,177, 5,310,453, 4,665,463, and European Patent Nos. 0856882 and 0692814, each as being of particular relevance alone. The applicant submits that while the references disclose a layer having vertical compliance, none of the references disclose a layer on a wafer holder having a compliant surface for supporting a substrate that expands or contracts in a direction parallel to the planar surface of the substrate.

III. Conclusion

It is respectfully submitted that the amended claims included on the attached substitute pages are novel and involve an inventive step that is not obvious to one skilled in the art in light of the cited references, either alone or in combination. It is further respectfully submitted that the amendments made to the claims do not amend or otherwise impact the description and drawings as originally filed.